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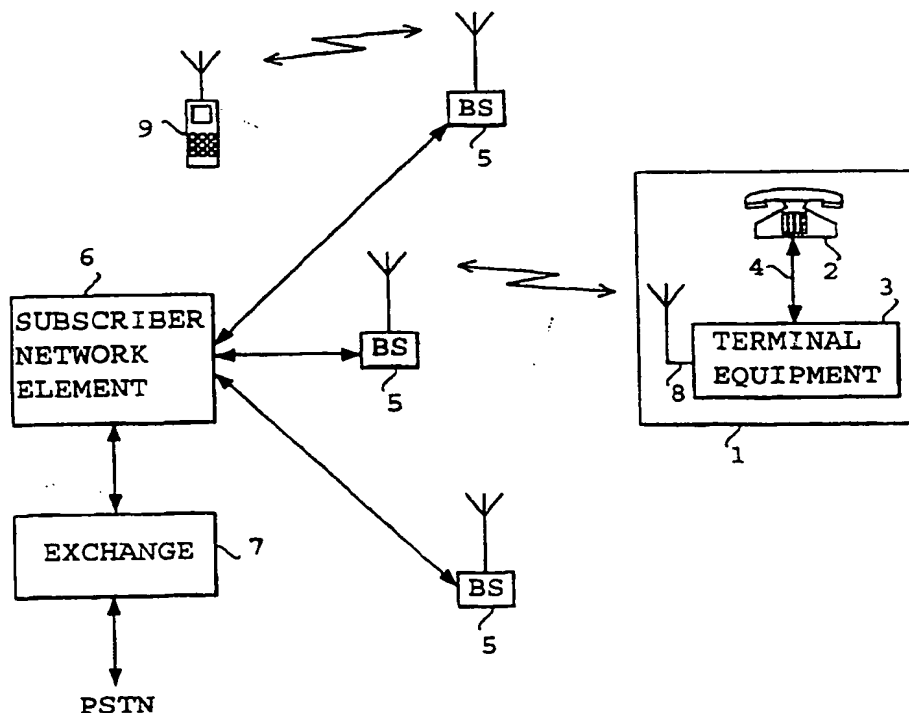
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<p>(21) International Application Number: PCT/FI95/00098</p> <p>(22) International Filing Date: 23 February 1995 (23.02.95)</p> <p>(30) Priority Data: 940857 23 February 1994 (23.02.94) FI</p> <p>(71) Applicant (for all designated States except US): NOKIA TELECOMMUNICATIONS OY [FI/FI]; Mäkkylän puistotie 1, FIN-02600 Espoo (FI).</p> <p>(72) Inventors; and</p> <p>(75) Inventors/Applicants (for US only): SARPOLA, Jussi [FI/FI]; Torikatu 16 B 14, FIN-90100 Oulu (FI). HEIKKILÄ, Vesa [FI/FI]; Kiiminginpolku 13, FIN-90570 (FI). TASKILA, Ari-Pekka [FI/FI]; Melojantie 1 A 8, FIN-90560 Oulu (FI). ASUJAMAA, Hannu [FI/FI]; Rysätie 6 A 4, FIN-90550 Oulu (FI). LIINAMAA, Olli [FI/FI]; Valtatie 77 B 38, FIN-90500 Oulu (FI). RUSI, Pekka [FI/FI]; Nylanderintie 5-7 A 4, FIN-90570 Oulu (FI).</p> <p>(74) Agent: OY KOLSTER AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).</p>		<p>(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).</p> <p><b>Published</b> <i>In English translation (filed in Finnish). Without international search report and to be republished upon receipt of that report.</i></p>

(54) Title: ACCOMPLISHING A REGISTER RECALL IN A RADIO SYSTEM

(57) Abstract

The invention relates to a method for accomplishing a register recall from a subscriber unit (1) of a radio system providing a wireless local loop, the radio system comprising a subscriber network element (6) and base stations (5) to transmit telecommunication signals between the subscriber units (1) and a public switched telephone network. To obtain a register recall in a simple and fast manner, a register recall frame is transmitted from the subscriber unit (1) in a conversation state of the unit to the subscriber network element (6), a message is awaited from the subscriber network element (6) about receiving the frame, and diallings input from a user interface (2) of the subscriber unit (1) are transmitted on a speech path via the subscriber network unit (6) to the public switched telephone network. The invention also relates to a subscriber unit (1) and a subscriber network element (6).



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## Accomplishing a register recall in a radio system

5 The invention relates to a method for accomplishing a register recall from a subscriber unit of a radio system providing a wireless local loop, the radio system comprising a subscriber network element and base stations to transmit telecommunication signals between the subscriber units and a public switched telephone network. The invention also relates to a  
10 subscriber unit of a radio system providing a wireless local loop, the subscriber unit comprising a terminal equipment and an user interface. The invention further relates to a subscriber network element of a radio system providing a wireless local loop, the subscriber  
15 network element having a data transfer connection with a telephone exchange and comprising means for establishing, via base stations, a radio connection to subscriber units located in the coverage area of the radio system, for transmitting telecommunication signals  
20 between the subscriber units and the exchange.

The invention relates to a WLL system, that is, a radio system providing a wireless local loop, in which system the subscriber units are connected by a radio connection via base stations and a subscriber network  
25 element to a public switched telephone network (PSTN) exchange. Any conventional type of user interface or telephone set can be connected to the WLL system by means of a special terminal equipment, the radio path being thus invisible to the user.

30 In this connection, a subscriber unit refers to the equipment the subscriber has for transmitting and receiving telecommunication signals, that is, in the case of the WLL subscriber unit, the subscriber unit comprises a WLL terminal equipment consisting of a radio  
35 part and a teleadapter, and a user interface, such as

a telephone, a telefax terminal, a computer/modem combination or the like, connected to the terminal equipment.

5       Subscribers of the WLL system should have  
access to a register recall and subscriber facilities  
required thereby in the same way as the subscribers of  
a normal wired network. Also in the case of a loop  
dialling telephone, the restrictions for use should also  
be similar to those for subscribers of a wired network,  
10       that is, of the subscriber facilities requiring a recall  
only trace is operative.

      The purpose of the present invention is to  
provide a register recall and subscriber facilities  
requiring it to subscribers of the WLL system. This  
15       object is achieved with the method of the invention,  
which is characterized in that a register recall frame  
is transmitted from the subscriber unit in a  
conversation state of the unit to the subscriber network  
element, a message is awaited from the subscriber  
20       network element about receiving the frame, and diallings  
input from the user interface of the subscriber unit are  
transmitted on a speech path via the subscriber network  
element to the public switched telephone network.

      The invention is based on the idea that the  
25       register recall and the facilities related thereto can  
be provided in a simple and fast manner when a recall  
frame and diallings following it are transmitted from  
a subscriber unit on a speech path, transmitted by a  
subscriber network element, to the fixed telephone  
30       network exchange so that the dialling in connection with  
the register recall frame can be analyzed at the  
exchange and the subscriber network element does not  
need to be able to analyze the dialling. The method of  
the invention is thus making use of features already  
35       existing in fixed telephone network exchanges. The most

significant advantage of the method of the invention is that the register recall and the facilities required thereby can be provided to subscribers in a simple and reliable way without making any new requirements on the features of the subscriber network element or without raising the price significantly.

The invention also relates to a subscriber unit with which the method of the invention can be applied. The subscriber unit of the invention is characterized in that the terminal equipment contains means for transmitting a register recall frame to the subscriber network element in response to a recall signal transmitted from the user interface, and means for transmitting diallings from the user interface on the speech path to the subscriber network element after receipt of a standby message.

The invention further relates to a subscriber network element with which the method of the invention can be applied and which is suitable to be used in connection with the subscriber unit of the invention. The subscriber network element of the invention is characterized in that the subscriber network element comprises means responsive to a recall frame transmitted by a subscriber unit

- for transmitting a standby message to the subscriber unit,
- for identifying the type of the subscriber unit that transmitted the recall frame,
- for sending a register recall message to the fixed telephone network exchange and
- for transmitting the diallings received from the subscriber unit on a speech path to the fixed telephone network exchange.

The WLL systems are generally based on a known cellular radio system in which the equipment of the WLL

system has been developed by simplifying components of the cellular radio system, by removing features not needed in the WLL system. However, it would be advantageous if the telephones of the cellular radio system used as a starting point could be used as subscriber units in the WLL system. Thus the subscriber network element of the invention preferably comprises means for handling diallings transmitted also as digit frames because, for example, the specifications of the NMT-450i system define that diallings after a register recall frame are transmitted specifically as digit frames.

The preferred embodiments of the method, the subscriber unit and the subscriber network element of the invention are disclosed in the appended dependent claims 2, 4 - 5 and 7.

In the following, the invention will be described by means of its first preferred embodiment with reference to the accompanying figures, of which

Figure 1 is a block diagram of a WLL system and

Figure 2 is a partial block diagram of the subscriber network element shown in Figure 1.

Figure 1 is a block diagram of a part of a WLL system in which the method of the invention can be applied. The WLL system in Figure 1 is based on an NMT-450i system that has been simplified by removing unnecessary features. Base stations 5 correspond to parts of the NMT-450i cellular radio system (Nordisk Mobil Telefon). As far as signalling is concerned, a subscriber unit 1 operates almost as a normal subscriber unit of the NMT-450i system. Through the base stations and a subscriber network element 6, calls can also be made with an ordinary mobile phone 9 of the NMT-450i system, provided that the network operator has programmed the subscriber network element 6 with a view

to connecting calls for such a phone. In such a case, said NMT telephone 9 can only be used, however, in the radio coverage area of one base station 5, as the subscriber network element shown in the figure does not include handover means with which an ongoing call could be transferred between base stations 5.

The subscriber unit 1 shown in Figure 1 comprises a telephone 2 and a terminal equipment 3. In Figure 1 the telephone 2 is an ordinary telephone using voice frequency dialling connectable to a fixed telephone network. In Figure 1 the telephone 2 and the terminal equipment 3 are connected by a two-wire lead 4, through which signals can be transmitted between the terminal equipment and the telephone. The terminal equipment 3 contains signal-processing means for adapting a speech path to a radio channel. Such signal-processing means are, for example, a radio part, consisting of an antenna 8, a radio transmitter and a radio receiver, and a teleadapter that adapts the radio part to an ordinary telephone 2.

The subscriber unit 1 is connected by means of radio frequency signals via the antenna 8 to the base station 5 (the figure shows three base stations BS), through which calls are transmitted to the subscriber network element 6 and further to the PSTN (Public Switched Telephone Network), that is, to a fixed telephone network exchange 7. The subscriber network element 6 is connected to a local exchange of the fixed telephone network with an open multiplexer connection of CCITT Q.512 V2 type using the 2 Mbit/s PCM system.

When a user of the telephone 2 in a conversation state presses the dial R (or dials 1 in the case of a telephone with loop dialling), the terminal equipment 3 transmits a register recall frame and moves to a so called R state to wait for an acknowledgement

utilizing time supervision. In the R state, the terminal equipment will not transmit the received telecommunication signals to the telephone 2. The subscriber network element 6 acknowledges the reception of the recall frame directly by sending a standby message to the subscriber unit 1 via the radio path. Immediately after transmitting the standby message, the subscriber network element sends a message "dialling sufficient" to the subscriber unit whereupon the terminal equipment 3 returns to the conversation state. If the subscriber network element does not send the standby message within a preset period of time, the terminal equipment 3 will return to the conversation state.

Figure 2 shows a partial block diagram of the subscriber network element 6 of Figure 1. Only those components of the subscriber network element that are needed for transmitting a register recall from the subscriber unit 1 or 9 in Figure 1 are shown in Figure 2. A register recall frame as defined in the NMT specifications, sent by the subscriber unit 1 or 9 is transmitted from a base station 5 to a control unit 10 of the subscriber network element. The control unit immediately acknowledges the reception of the frame by sending a message via the base station 5 to the subscriber unit. After this, the type of the subscriber unit that transmitted the frame is identified in an identification block 11.

In case the subscriber unit 1 comprises an ordinary telephone set and a WLL terminal equipment, the control block 10 transmits a register recall immediately to the PSTN exchange. The exchange will not acknowledge the recall in any way, but will switch on a dialling tone which the subscriber network element transmits directly to the subscriber unit 1. The user of the



subscriber unit will hear the dialling tone, after which the user dials the number on the phone. This dialling is transmitted in voice frequency directly on a speech path via the subscriber network element 6 to the PSTN exchange.

5                   However, if the identification block 11 identifies a mobile telephone of the NMT-450i cellular radio system, the control block 10 starts to receive single digit frames, as defined in the NMT  
10 specifications, transmitted from the mobile telephone 9 and forwarded via a base station 5 and to input the included digit information to a buffer 12. A timer 13 measures the time passed since the previous digit was input to the buffer. When said time measured by the  
15 timer 13 exceeds the preset time limit, the control block 10 assumes that the dialling transmitted from the NMT telephone is received in whole whereupon the control block 10 transmits to the mobile phone 9 a message "dialling received" as defined in the NMT  
20 specifications, and to the PSTN exchange a register recall and the digits stored in the buffer 12, preferably as a voice frequency dialling.

Consequently, the subscriber network element of the invention can also handle a register recall  
25 transmitted by a mobile telephone in the NMT-450i system, even though it does not include means for analyzing the dialling transmitted from the mobile telephone (by means of which an MTX exchange of the NMT-450i system can for example determine when the dialling  
30 is received in whole).

It is to be understood that the above description and the figures related thereto are only meant to illustrate one preferred embodiment of the invention without restricting the invention itself  
35 thereto. Thus the arrangement of the invention can also

be used in such WLL systems that are based on some other  
cellular radio system than the NMT-450i system shown  
above by way of example. Therefore, the preferred  
embodiments of the method, the subscriber unit and the  
5 subscriber network element of the invention may vary  
within the scope of the appended claims.

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## Claims:

1. A method for accomplishing a register recall from a subscriber unit (1) of a radio system providing a wireless local loop, the radio system comprising a subscriber network element (6) and base stations (5) to transmit telecommunication signals between the subscriber units (1) and a public switched telephone network, c h a r a c t e r i z e d in that
- 5 a register recall frame is transmitted from the subscriber unit (1) in a conversation state of the unit to the subscriber network element (6),
- 10 a message is awaited from the subscriber network element (6) about receiving the frame, and
- 15 diallings input from a user interface (2) of the subscriber unit (1) are transmitted on a speech path via the subscriber network element (6) to the public switched telephone network.
2. A method as claimed in claim 1, c h a r -
- 20 a c t e r i z e d in that the diallings input from the user interface (2) are voice frequency diallings.
3. A subscriber unit (1) of a radio system providing a wireless local loop, the subscriber unit comprising a terminal equipment (3) and an user interface (2), c h a r a c t e r i z e d in that the
- 25 terminal equipment (3) contains means for transmitting a register recall frame to the subscriber network element (6) in response to a recall signal transmitted from the user interface (2), and means for transmitting
- 30 diallings from the user interface (2) on a speech path to the subscriber network element (6) after receipt of a standby message.
4. A subscriber unit as claimed in claim 2 or 3, c h a r a c t e r i z e d in that the user interface
- 35 (2) is a voice frequency dialling telephone in which

said recall signal is created by pressing the R dial in the conversation state of the subscriber unit.

5           5. A subscriber unit as claimed in claim 2 or 3, c h a r a c t e r i z e d in that the user interface (2) is a loop dialling telephone in which said recall signal is created by dialling 1 in the conversation state of the subscriber unit.

10           6. A subscriber network element (6) of a radio system providing a wireless local loop, the subscriber network element having a data transfer connection with a telephone exchange (7) and comprising means for establishing, via base stations (5), a radio connection to subscriber units (1, 9) located in the coverage area of the radio system, for transmitting telecommunication  
15           signals between the subscriber units (1, 9) and the exchange (7), c h a r a c t e r i z e d in that the subscriber network element (6) comprises means responsive to a recall frame transmitted by a subscriber unit (1, 9)

20           - for transmitting a standby message to the subscriber unit (1, 9),  
              - for identifying the type of the subscriber unit (1, 9) that transmitted the recall frame,  
              - for sending a register recall message to the  
25           fixed telephone network exchange (7) and  
              - for transmitting the diallings received from the subscriber unit (1) on a speech path to the fixed telephone network exchange (7).

30           7. A subscriber network element as claimed in claim 6, c h a r a c t e r i z e d in that the subscriber network element (6) also comprises

              - storage means (12) responsive to the identification means (11) for buffering the diallings received from the subscriber unit (9) as digit frames,

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- timer means (13) responsive to the storage means (12) for measuring the time elapsed since the reception of the previous frame and

5       - means (10) responsive to the timer means (13)  
for transmitting the buffered diallings to the fixed  
telephone network exchange (7) and for sending a  
predetermined message to the subscriber unit (9) when  
the time elapsed since the reception of the previous  
frame exceeds a predetermined time limit.

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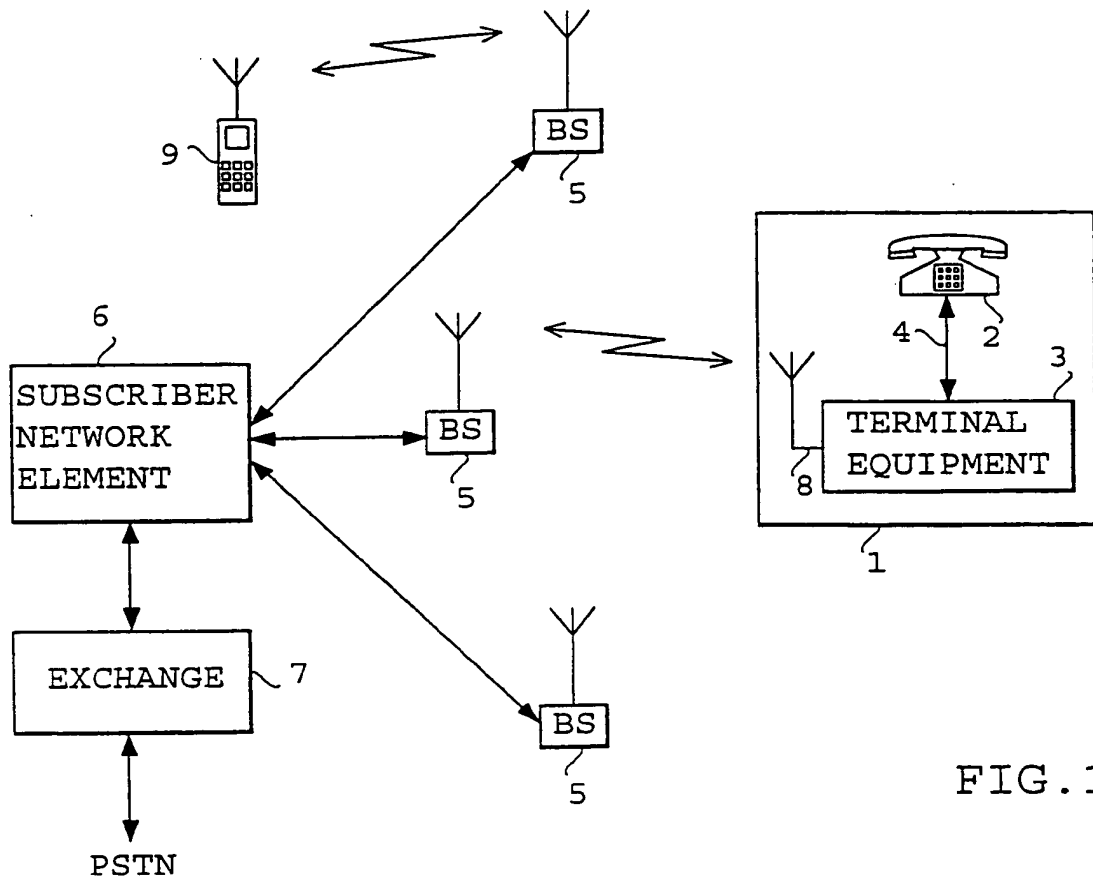


FIG. 1

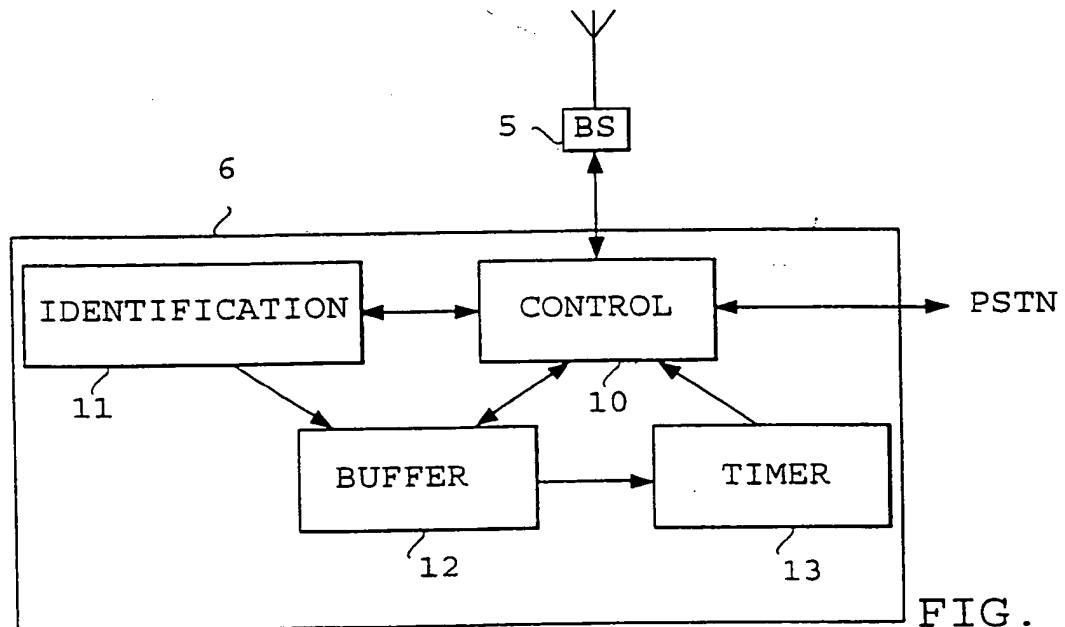


FIG. 2